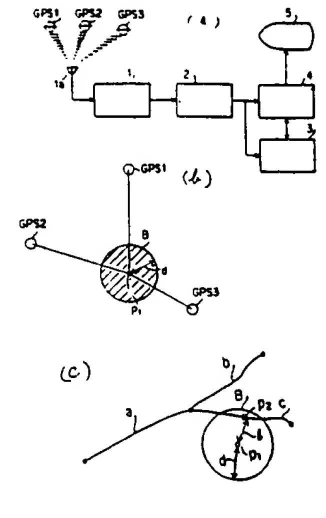
(54) POSITION DETECTING DEVICE FOR MOVING BODY

(11) 3-291583 (A) (43) 20.12.1991 (19) JP
(21) Appl. No. 2-93381 (22) 9.4.1990
(71) MITSUBISHI ELECTRIC CORP (72) SHUICHI NISHIKAWA(1)
(51) Int. Cl[5]. G01S5/14

PURPOSE: To detect the position of the moving body with high accuracy by determining the position of the moving body by comparing position data which indicates an error range including a position generated with the signals of GPS satellites with a relative map.

CONSTITUTION: A GPS computing element 2 outputs 1st position data on a circle B with a radius (d) including a 1st position shown in a figure (b) according to the received signals from the GPS satellites GPS1 · GPS3, reads map data showing a map of the periphery of the circle B, e.g. a map including roads (a) · (c) as shown in a figure (c) out of a map data memory 3, and matches the 1st position data with the map by a map matching computer element 4 to find the road (c) in the circle B and a position P_2 at the shortest distance (e) from the position P_1 on the road (c), thereby outputting their data. Consequently, the map including the roads (a) · (c) and the position P_2 showing the current position of the moving body on the road (c) are displayed on a display unit 5.



1: GPS receiver

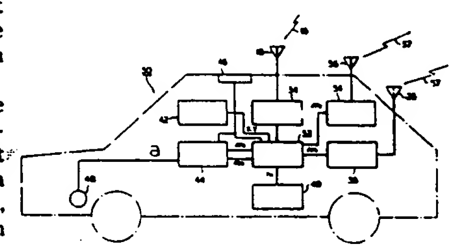
Ref. 1

(54) NAVIGATION DEVICE FOR VEHICLE

(11) 3-291584 (A) (43) 20.12.1991 (19) JP
(21) Appl. No. 2-95849 (22) 10.4.1990
(71) TOYOTA MOTOR CORP (72) TOSHIMASA MIKAWA
(51) Int. Cl[5]. G01S5/14,G01C21/00

PURPOSE: To eliminate fixed stations and correct GPS position measurement data, and to improve the position measurement accuracy by correcting the GPS position measurement data with correction data found by the navigation device of the this vehicle or external correction data.

CONSTITUTION: A GPS reception part 34 finds the distance to a GPS satellite with a received satellite radio wave 16 and then finds the GPS position measurement data from the distance. Then a control part 52 compares the current travel position of this vehicle determined with the position measurement data with the position of the closest intersection on map data at a recording part, converts it into travel position coordinates X and Y, and displays them on a screen, and data ΔP_k is radiated 56 from a transmission part 54 with a mobile station radio wave 57. A reception part 36, on the other hand, receives another mobile station radio wave 57 through an antenna 26, and extracts and supplies correction data ΔP_k to a control part 52. The control part 52 when inputting the correction data ΔP_k does not calculate the correction data ΔP_k by the navigation device 50 of this vehicle, but finds the travel position coordinates with the input data ΔP_k and displays it.



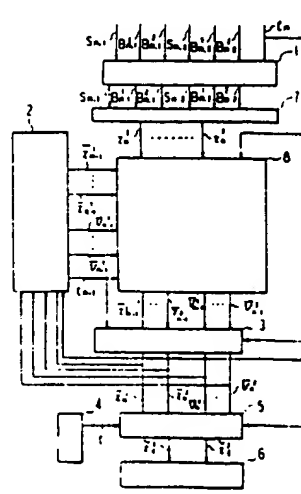
36: reception part. 40: recording part. 42: display part. 44: estimation navigation part. 46: azimuth sensor. 48: distance sensor. 52: control part. 54: transmission part. a: travel distance

(54) METHOD AND DEVICE FOR TRACKING

(11) 3-291585 (A) (43) 20.12.1991 (19) JP
(21) Appl. No. 2-94475 (22) 10.4.1990
(71) MITSUBISHI ELECTRIC CORP (72) SHINICHI TANAKA
(51) Int. Cl[5]. G01S5/28,G01S15/66

PURPOSE: To track plural estimated target paths as many as candidates for an observation point by deciding the predicted point which is closest to a candidate for the observation point as a last smooth position and a smooth speed vector for the candidate for the observation point.

CONSTITUTION: All possible intersections of detection azimuth lines considered from combinations of, for example, detection azimuths $B^1_{n \cdot k}$ and $B^2_{n \cdot k}$ ($k = 1, 2$) are calculated 7 as the candidates x^k_n ($j = 1 \ldots$) for the observation point and a last smoothing quantity selecting device 8 reads one last smoothing position vector x^i_{n-1} and smoothing speed vector v^i_{n-1} out of a storage device 2, and calculates and outputs (j) last smoothing position vector s x^j_{n-1} and smooth speed vectors v^j_{n-1} matching (j) candidates x^j_n for the observation point to a smooth device 3. The device 3 performs smoothing calculation by using those vectors and the position vector x^j_n of one candidate for the observation point and outputs (j) smoothing positions at tiem t_n and smoothing speed vectors x^j_n and v^j_n to a present predicated position calculating device 5. Then the (j) predicted position vectors x^j_c at current time (t) which are calculated by the device 5 are displayed 6 as symbols, etc.



3: smooth device. 2: storage device. 4: current time output device. 5: current predicted position calculating device. 6: display device. 7: observation point candidate calculating device

Partial Translation of Reference 1

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Int.Cl.: G01S 5/14, G01C 21/00

A. Page 4, lower right column, line 8 to page 5, upper right column, line 6:

In a vehicle navigation apparatus 50 according to the present invention, a control unit 52 has a map matching function. A transmission unit 54 and an antenna 56 for transmitting correction data to a vehicle navigation apparatus mounted on the other vehicle are also provided.

A GPS reception unit 34 receives a satellite radio wave 16 by an antenna 18, and demodulates it to generate a satellite signal. The GPS reception unit 34 further executes the GPS operation in accordance with the satellite signal. The GPS operation is to obtain a distance from a GPS satellite 10 and obtain the GPS positioning data on the basis of this distance. The GPS positioning data is supplied from the GPS reception unit 34 to the control unit 52. The control unit 52 stores a current running position Pn of a vehicle 14 determined in accordance with the GPS positioning data that is input from the GPS reception unit

34, and refers to the position Pn, in the map data stored in a memory unit 40.

The memory unit 40 supplies a point of intersection Pm that is nearest to the position Pn to the control unit 52. The control unit 52 operates correction data ΔPk on the basis of

$$\Delta Pk = Pn - Pm$$

The correction data ΔPk is converted into coordinates X and Y of the running position of the vehicle 14. The converted data is displayed on a screen of a display unit 42 together with the map data.

On the other hand, the correction data ΔPk is supplied to the transmission unit 54. The transmission unit 54 transmits the correction data ΔPk from the antenna 56 by use of a mobile station radio wave 57. The mobile station radio wave 57 is received by, for example, the vehicle navigation apparatus mounted on the other vehicle. The reception unit 36 also receives the mobile station radio wave 57 with the antenna 26 and demodulates it. The reception unit 36 further extracts the correction data ΔPk from the demodulation results and supplies the data to the control unit 52. When the control unit 52 inputs the correction data ΔPk from the reception unit 36, the control unit 52 does not operate the correction data ΔPk on the basis of the GPS positioning data, but determines and displays the running position coordinates X and Y on

the basis of the correction data ΔPk received from the reception unit 36.